

Chemistry 1905 Freshman Honors Seminar

Chemistry to Modern Medicine: Changing the way we “Dye”

W 1:25 – 3:55 PM
Room Smith 111
Spring Semester, 2017

Instructor: Professor William Pomerantz, 312 Smith Hall

Prof. Pomerantz’ Office Hours: To accommodate diverse schedules, office hours can be scheduled via appointment. Please send an email to Prof. Pomerantz wcp@umn.edu with the topic CHEM1905 in the subject line.

Course Website: Our Moodle Site (3.0) CHEM 1905 CHEMISTRY TO MODERN MEDICINE will be up in January and will be updated throughout the semester. You can navigate to the site from <http://www.onestop.umn.edu/>

Course Overview: Over the last three centuries, chemistry has evolved from a field based on scientific curiosity and inquiry to a central science that continues to impact our daily lives with life-saving medicines and high-tech materials. The personal narratives that led to these discoveries are both exciting and informative about how we view this science in its current form. To provide a foundation for understanding the chemistry that affects our everyday lives, this course will discuss the stories behind several landmark discoveries, from the foundational work in synthetic dyes that color our clothes, to the search for Ehrlich’s “magic bullets” that led to the first antibiotics and anti-cancer drugs. Course content will be focused around excerpts from written texts including *Emperor of all Maladies*, *The Billion Dollar Molecule*, and *Mauve*. On-campus field trips, invited speakers, inspirational TED talks, and interactive hands-on exercises will also be incorporated into our exploration uncovering the wonders of chemistry for discovering new medicines and their impact on our daily lives. No advanced chemistry background is required.

Course Materials: Printout from required readings will be provided. Readings will be taken from contemporary literature for providing a narrative to early and recent discoveries that have shaped the field of modern medicine. These readings will be used to help shape discussion in the class. Example books include: “*Mauve: How One Man Invented a Color that Changed the World*” by Simon Garfield. “*Billion Dollar Molecule*” by Barry Werth, “*Emperor of All Maladies*” by Siddhartha Mukharjee, *The Mold In Dr. Flory’s Labcoat: The Story of the Penicillin Miracle*” by Ed Lax, and *The Immortal Lifeline of Henrietta Lacks* by Rebecca Skloot.

Learning Goals for the Class:

1. Students will gain an appreciation for the three dimensional structure of molecules and how that affects their biological function
2. Students will gain an increased appreciation for the role chemistry can play to impact other fields of science, and the stories behind the scientists and their discoveries
3. Students will be able to give an effective oral presentation about a scientist, medicine, or novel discovery
4. Students will be able to develop a written document describing a scientist, medicine, or novel discovery suitable for *Wikipedia*.

Grading

Class Participation	20%
Assignments	30%
In-Class Presentation:	20%
Science Write-up draft	10%
Science Write-up:	20%

Class participation: The class size is small and so the expectation is that instructor and students will be able to actively engage in the course material. Coming to class prepared will allow for a fun dynamic semester. Several opportunities will allow for meeting with scientists both on and off campus. Being prepared to engage with these scientists is expected to enhance your learning experience as well as learn more about resources available to you at UMN.

Reading Assignments: Regular readings will be provided throughout the semester. There can be specific scientific jargon that may need to be further explained. Short assignments will be given for each reading to facilitate the subsequent discussion and help enhance the learning experience. More specific guidelines will be provided in class as well as on MOODLE

In-class presentation: The capstone project will be to provide a write-up covering a scientist, discovery, or modern medicine. An intermediate goal will be to give a short presentation (~5 minutes), introducing the topic you have chosen. More specific guidelines will be provided in class as well as on MOODLE to help facilitate this topic choice.

Final Write-up. *Wikipedia* has become an invaluable research for learning about disparate topics. Many scientists and their discoveries however remain unreported. As a final write-up on a topic relevant to this course but not covered on *Wikipedia*. You will turn in a written report that would be suitable for eventual publication on this site if we decided to do so. More specific guidelines will be provided in class as well as on MOODLE to help facilitate this topic choice and further feedback will be provided as you compile this document. A rough draft will be due in early April to allow for feedback on your topic of interest.

Accommodations: I would like you all to have equal opportunities for success, if you need special accommodations for the course please consult with student services so that we can find the best solution possible. <https://diversity.umn.edu/disability/accommodationsandservices>

Policy on missed work and assignments for Legitimate Absences: Before discussing this issue with me, please review the Administrative Policy for Legitimate Absences: <http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html> and see if your absence qualifies as legitimate, as defined by the University. When discussing the matter with me, ready to provide information and contacts related to the absence. Accommodations for make-up work will be made on a case-by-case basis. Due to the small class size, contact me as soon as possible when an excused absence is applicable.

Policy on Incomplete Grades: An “I” will be received in the course only when a prior agreement has been made with the instructor and paperwork filed. “I” grades will be considered if the final project cannot be taken and progress until that point is deemed satisfactory. The “I” can be made during the following semester according to the guidelines set forth by you and the instructor. If the final or additional necessary work is not taken and/or deemed satisfactory, an “F” or an N grade will be assigned

Contact Information: You must use your University of Minnesota x-500 email account so that I can send you information and updates regarding this course. I will keep CHEM 1905 in the subject line. *Please use the same heading so that I can readily attend to your email.* I will do my best to respond within 24 h.

Scholastic Dishonesty: Academic misconduct is not tolerated and may result in either a failed assignment or failure from the course. According to University policy scholastic misconduct is broadly defined as "any act that violates the right of another student in academic work or that involves misrepresentation of your own work. Scholastic dishonesty includes, (but is not necessarily limited to): cheating on assignments or examinations; plagiarizing, which means misrepresenting as your own work any part of work done by another; submitting the same paper, or substantially similar papers, to meet the requirements of more than one course without the approval and consent of all instructors concerned; depriving another student of necessary course materials; or interfering with another student's work."

My Expectations for students in my class

- 1) Coming to class prepared
- 2) Taking notes and actively participating
- 3) Staying current with reading and assigned problems.
- 4) Asking questions and seeking help when a concept is not clear.

Please **be selfish with your education** and get the most out of the course. My office is open to you to help you learn about this exciting material. Good luck and I hope you enjoy the class as much as I have been putting it together!

Important Dates

Topic for Write-up due
 Write-up draft due
 Short Oral presentation
 Final Write-up due
 No Final Exam

Wed. March. 22nd
 Wed. April 5th
 Wed. April 12th
 Wed. May 3rd

Course Outline and Recommended Problems

Week	Topics	Activities, Readings (P)
1. Jan. 18	Discovery of Mauve (William Perkin)	<i>Bradner Video, Fold it, Molecular Models*</i> Mauve: Chap. 1 3-13, Chap 3. p23-34
2. Jan. 25	Mauve Part II Synthesis and Dyes	<i>Bradford Dye Lab intro:</i> Mauve: Chap 4 35-49 <i>Demon under the Microscope</i> Pages 78-85
3. Feb. 1	Paul Ehrlich and the Magic Bullet Introduction to sulfa drugs	https://www.youtube.com/watch?v=0V8Hd5lfheY https://www.youtube.com/watch?v=bSDCMhxx-zw <i>Bradford Dye Lab II:</i> <i>Demon under the Microscope</i> Chapter 8: pages 100-108, Chapter 10: pages 125-138
4. Feb. 8	Gerhard Domagk The sulfa drug discovery story The FDA	<i>The Mold on Dr. Florey's Lab Coat</i> Chap 1. 7-31
5. Feb. 15	William Fleming and "Penicillin Mold Juice" Meet a Scientist I	Meet with Prof. Erin, Carlson <i>The Mold on Dr. Florey's Lab Coat</i> Chap. 6 85-113
6. Feb. 22	Florey, Chain, Beta-Lactam antibiotic Human Genome	<i>Eric Lander Video Virtual lab</i> <i>Billion Dollar Molecule:</i> Chapter 1 11-36
7. Mar. 1	Billion dollar molecule (1). Biotechnology & Drug Discovery	<i>Stuart Schreiber Video I</i> Pomerantz Lab Research <i>Billion Dollar Molecule:</i> Chap 4 59-78
8. Mar. 8	Billion dollar Molecule (2) Meet a Scientist II	<i>ITDD tour, Pfizer video</i> Meet with Prof. Gunda Gunda <i>Billion Dollar Molecule:</i> Chap 13 236-252
9. Mar. 15	SPRING BREAK	SPRING BREAK,
10. Mar. 22	Billion dollar Molecule (3), screening, Protein-visualization	<i>Stuart Shreiber Video II</i> MSI Walter library rm 125 protein visualization , <i>Henrietta Lacks:</i> Chap. 1, 13-17, Chap. 3 34-41 <i>Submit topics for write-up</i>

11. Mar. 29	Henrietta Lacks, HeLa cells, cancer Meet a Scientist III	NIH NCI Skype meeting with Dr. Jay Schneekloth <i>Emperor of all Maladies</i> : pages 11-36
12. Apr. 5	Emperor of all Maladies (I) Cancer and early drugs (antifolates)	Pomerantz away: work on writing, <i>Initial draft due</i> Emperor of All Maladies video (PBS) <i>Emperor of all Maladies</i> : pages 423-440
13. Apr. 12	Emperor of all Maladies (II) Cancer and Modern Drugs (Gleevac, Herceptin)	Emperor of All Maladies video <i>Oral Presentation</i> <i>Visit to lab with tissue culture (time permitting)</i>
14. Apr. 26	Writing	Pomerantz away, work on writing.
15. May 3	Catch-up	Wrap up for the class, course evaluations

* **Protein visualization software PyMol.**

Software can be downloaded for free at: <http://pymol.org/educational/> . Register for educational use only. An email will be sent with a prefabricated user name and password along with a URL to download the software from. Click on Educational use only. PyMol is also available in the microlab.